



**Regeneration Delay Validation and
Effect on Allowable Cut
in the Nelson Forest Region**

Technical Report MIT-004

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1.0 Introduction

Regeneration delay (RD) is an important factor in determining two essential components of Annual Allowable Cut (AAC) in the Timber Supply Review (TSR) analysis. First, RD is part of the total rotation length, and therefore has impacts on the Long Run Sustainable Yield (LRSY). It is also a component of greenup time. Greenup delay is composed of regeneration delay plus the time required to grow from establishment to the desired average height. Greenup affects adjacency, a critical factor in short term wood availability. Reductions in RD can therefore affect wood supply both in the long and short term.

2.0 Objectives

The purpose of this study is to confirm regeneration delays (RD) used in TSR analysis using actual data from regenerated stands. In particular, the objectives are to:

- i) compare, for each analysis unit (AU) the assumed RD used in TSR analyses with the actual RD as recorded in ISIS and MLSIS.
- ii) ascertain the impact of silviculture treatments, especially planting and site preparation, on RD.
- iii) estimate the impact of the changes in RD on short and long term allowable cuts.
- iv) recommend appropriate RD and silviculture treatment assumptions for future TSR analyses.

3.0 Methodology

Regeneration delays were assessed using the MLSIS and ISIS data bases. Data was received from Victoria headquarters in the form of ACCESS tables. All openings logged since 1988 (when PHSPs/SPs became legally required) that were sufficiently restocked were included. Each opening was sorted by Biogeoclimatic Ecosystem Classification (BEC) down to the site series level. Site productivity for each site series was estimated based upon site index/biogeoclimatic (SIBEC) correlation data in consultation with the Regional Ecologist. Site productivity and the leading species in the silviculture label of the largest strata in the opening were then combined to assign an AU for each block. The AUs were based upon the AUs planned for use in the next round of Timber Supply Reviews (TSRs). Regeneration delays for each opening were then calculated based upon the disturbance date and regeneration date in the data base.

A total of 2508 openings were used in the calculations.

Once the data sorting and conversions were completed, queries were run to compare the actual RD with the maximum RD shown in the Establishment to Free Growing (EFG) Guidebook for each site series. The Guidebook RD was chosen to represent the current TSR regeneration delays because:

- i) The more recent TSRs (e.g. Cranbrook) used RDs of 4 years for areas that were normally planted and 7 years for areas that were left for naturals. This correlates with the recommendations for maximum RDs in the Guidebook.
- ii) Older TSRs (e.g. Revelstoke) did not use explicit RDs, but used VDYP curves that included regeneration delay. In order to compare the effects of RD on potential wood supply, a standard comparison was needed. The Guidebook RDs are a good approximation of the RDs used in these TSRs.

The MLSIS/ISIS data base also allowed comparisons to be made based on silviculture activity. In particular, planting and site preparation activities were sorted to judge their effects on RD. Some runs were also made on the intensity of silviculture treatment (the total number of silviculture treatments on a block). For every type of basic silviculture activity (planting, site preparation, or brushing) a score of 1 was given to the opening. Multiple treatments were not scored extra. Every opening therefore had an intensity rating of 0 (no treatment) to 3 (planting, site preparation, and brushing).

Regeneration delay comparisons were made showing differences in the average RD between AUs, whether planted or not, type of site preparation treatment, and intensity of silviculture activity. The AU comparisons were also used to run FSSIM analyses for the Cranbrook and Revelstoke TSAs to estimate the potential wood supply implications. All the AUs had sufficient openings to give a reliable average for the Region, with the exception of AU 4 (H,C-p) which had only 4.

4.0 Results and Discussion

4.1 Actual RD by Analysis Unit

For each AU, the average of the estimated EFG Guidebook and the actual RDs are shown in Table 1. As one would expect, actual and estimated RD differed considerably by AU. In the AUs where one would expect planting (higher site quality, species other than Pl) RDs are lower than where natural regeneration would be expected. Most importantly, the actual RD in each AU is from 2 to 4 years less than the maximum allowable in the EFG Guidebook. This result suggests that many areas have longer RDs to allow for natural regeneration, yet they are being planted anyway.

4.2 Effect of Stand Origin

Table 2 summarizes the effect of stand origin, whether the opening was regenerated by natural or artificial means. The use of planting reduced the average RD by approximately 2 years. However, of the 2508 openings, 2196 or 88% were planted. Although planting will significantly reduce RD, this strategy is already being heavily used by Districts and Licensees. The potential for increasing planting is limited. It is clear, though, that the maintenance of the current planting program (and the associated site preparation and brushing treatments to ensure success) is essential to successfully regenerating stands in a timely fashion.

- **The decision to plant results in a large reduction in RDs, and therefore the planting program is strategically important.**

4.3 Effect of Site Preparation

The effect of site preparation on RD was also investigated. Because many of the detailed methods were not used in enough openings, no valid comparison could be made of their effect. However, Table 3 summarizes the overall effect of site preparation. There is effectively no difference in average RD as a result of treatment. This result can be explained as follows:

- i) About 83% (2083) of the openings were not site prepared. As explained above, most of the blocks were planted. Clearly planting effects on RD has masked the effect of site preparation.
 - ii) Site preparation is scheduled for areas that need it the most. Areas left unprepared are felt by the prescribing forester to be acceptable as is for either natural regeneration or planting. As a result, the average RD is "homogenized" by leaving only blocks with a high likelihood of success in the unprepared category and treating blocks that would otherwise have extended RDs.
 - iii) Site preparation on its own does not decrease RDs. Follow up planting (or natural regeneration) actually regenerates stands. The impact of site preparation is to create a suitable seedbed or planting spot that will result in more successful establishment and rapid growth of trees. Site preparation is a necessary precondition for successful crop establishment on many sites, but it is the actual planting date that determines RD.
- **Site Preparation does not directly influence RD, but is an essential component of crop establishment (along with planting and brushing) that determines RD.**

4.4 Effect of Basic Silviculture Treatments

The last analysis done was to evaluate the impact of silviculture treatments on RD. Table 4 illustrates the effect of silviculture intensity. Only 6% of the blocks had no silviculture treatments carried out. All the rest had at least one treatment; 60% had 2 or more. The RD dropped by about 1 year if silviculture activity was carried out, with no significant difference by intensity.

These data confirm that silviculture treatments significantly reduce RD. However, increasing intensity did not affect RD because:

- i) All the silviculture treatments other than planting served to help trees get established and increased growth, but did not directly impact RD. Brushing in particular only affected RD in so far as it prevented plantation failure. Silviculture treatments may decrease greenup delay, however.
- ii) It would be expected that increased silviculture activity would be prescribed where it was needed. A lower level of silviculture activity likely indicates a lesser need for treatment because of biological and site factors. As a result, less silviculture would not necessarily mean longer RDs.

4.5 Short-term Wood Supply and Long Run Sustainable Yield

Overall, there is a significant reduction in RD for each AU, and it was expected this reduction in rotation length would increase both short-term wood supply and LRSY. Nonetheless, when the new RDs were used to estimate allowable cuts in the FSSIM model, Long Run Sustainable Yield (LRSY) was unchanged in both the Cranbrook TSA and Revelstoke TSAs (MacLean 1996) when the TSR 1 base cases were modeled with revised RDs. The TSR analyst explained this result indicated that factors other than RD were limiting both short-term wood supply and LRSY.

When regeneration delay was combined with revised greenup delay data, positive effects to both the short-term wood supply and LRSY were noted. This combined approach and wood supply analysis are contained in a subsequent technical report (Reichenback 1996).

In summary, although a short-term mitigative effect was not observed using TSR 1 methodology with revised regeneration delays alone, any reduction in regeneration and/or greenup delay will result in increased flexibility for future harvesting, and the positive lifts noted in the above-referenced reports, are significant.

5.0 Conclusions and Recommendations

5.1 Use of Lower Actual Regeneration Delays for Future TSRs

RD values 2-3 years smaller than current estimates, are justifiable for future TSR analyses. When combined with decreased growing time to greenup, the result can positively affect LRSY (by decreasing average rotation length) and short term wood availability (by decreasing total greenup time), except in cases where other factors are limiting. It requires little effort - one day per district - to produce TSA-specific analyses of regeneration and greenup delays. There are no technical obstacles to producing these data for the Revelstoke, Arrow and Golden TSAs, as part of the TSR 2 data packages.

5.2 Maintain Basic Silviculture Practices

A progressive program of basic silviculture practices appears to be the reason that actual RDs are lower than the maximum recommended EFG Guidebook and TSR 1 values. While actual RDs should logically be used for TSR 2 purposes, we caution that the commitment to basic silviculture must remain. On this point, continuation of the historic levels of planting is essential for minimizing RDs. Site preparation and brushing are also important components of crop establishment. Without them tree growth is certainly lower and survival is jeopardized. A concern is recent downward trends in site preparation, prescribed fire, and brushing activities.

Current silviculture treatments seem to have ensured plantation establishment with positive reductions in RD; future efforts will focus on tree growth, affecting greenup as modeled in Reichenback (1996).

5.3 Potential for Regeneration Delay Reduction Using More Intensive Silviculture Practices

Intensive silviculture practices will provide only limited decreases in RD. Planting can be used further, even on those sites currently reforested successfully through natural regeneration. However, because most sites are already planted, it would appear there is little gain overall for the large extra expenditure involved. Site preparation and brushing are not likely to reduce RD on their own, yet these practices ensure planting will be successful (and not need to be repeated) as well as significantly increasing growth.

5.4 Administrative Efficiencies

Administrative practices can provide some positive gains. By shortening the length of Timber Sales and minimizing extensions, planting will be hastened in two ways. First, the areas will be available for silviculture treatment sooner. Secondly, the uncertainty caused by extensions will be reduced, allowing better planning (advance ordering of seedlings, earlier planned site preparation) and more efficient implementation.

6. References

MacLean, H.R. 1996. Personal communication.

Reichenback, G.R. 1996. Effect of Silviculture Practices on Greenup Delay in the Nelson Forest Region. B.C. Min. For. Internal Report MIT-004. Nelson, B.C.

Tables

Table 1: Regeneration Delay Summary by AU

Analysis Unit	N	Avg. RD From FPC Guidebook	Avg Actual RD	RD Reduction
1 - F,L,Py,(Pw)- g	563	4.94	2.13	2.81
2 - F,L,Py,(Pw)- m	264	6.82	3.44	3.38
3 - F,L,Py,(Pw)- p	105	6.97	4.08	2.89
4 - H,C-all	304	4.53	2.52	2.01
5 - S,B-g,m	603	4.85	2.61	2.24
6 - S,B-p	163	6.80	2.93	3.87
7 - Pl,(Pa)-g,m	324	5.52	2.67	2.85
8 - Pl,(Pa)-p,(l)	144	6.73	3.26	3.47

Table 2: Regeneration Delays Summary by AU and Stand Origin

Analysis Unit	Stand Origin	N	Avg. RD From FPC Guidebook	Avg Actual RD
1 - F,L,Py,(Pw)- g	ART	530	4.87	2.01
1 - F,L,Py,(Pw)- g	NAT	33	6.09	3.98
2 - F,L,Py,(Pw)- m	ART	185	6.82	2.94
2 - F,L,Py,(Pw)- m	NAT	79	6.81	4.59
3 - F,L,Py,(Pw)- p	ART	47	7.00	3.43
3 - F,L,Py,(Pw)- p	NAT	58	6.95	4.60
4 - H,C-all	ART	285	4.48	2.50
4 - H,C-all	NAT	19	5.26	2.90
5 - S,B-g,m	ART	568	4.76	2.57
5 - S,B-g,m	NAT	35	6.31	3.28
6 - S,B-p	ART	148	6.78	2.74
6 - S,B-p	NAT	15	7.00	4.80
7 - Pl,(Pa)-g,m	ART	282	5.33	2.26
7 - Pl,(Pa)-g,m	NAT	42	6.79	5.39
8 - Pl,(Pa)-p,(l)	ART	119	6.70	2.93
8 - Pl,(Pa)-p,(l)	NAT	25	6.88	4.86
9 - Deciduous	ART	32	5.41	1.04
9 - Deciduous	NAT	6	6.00	2.91
All	ART	2196	5.30	2.44
All	NAT	312	6.61	4.38

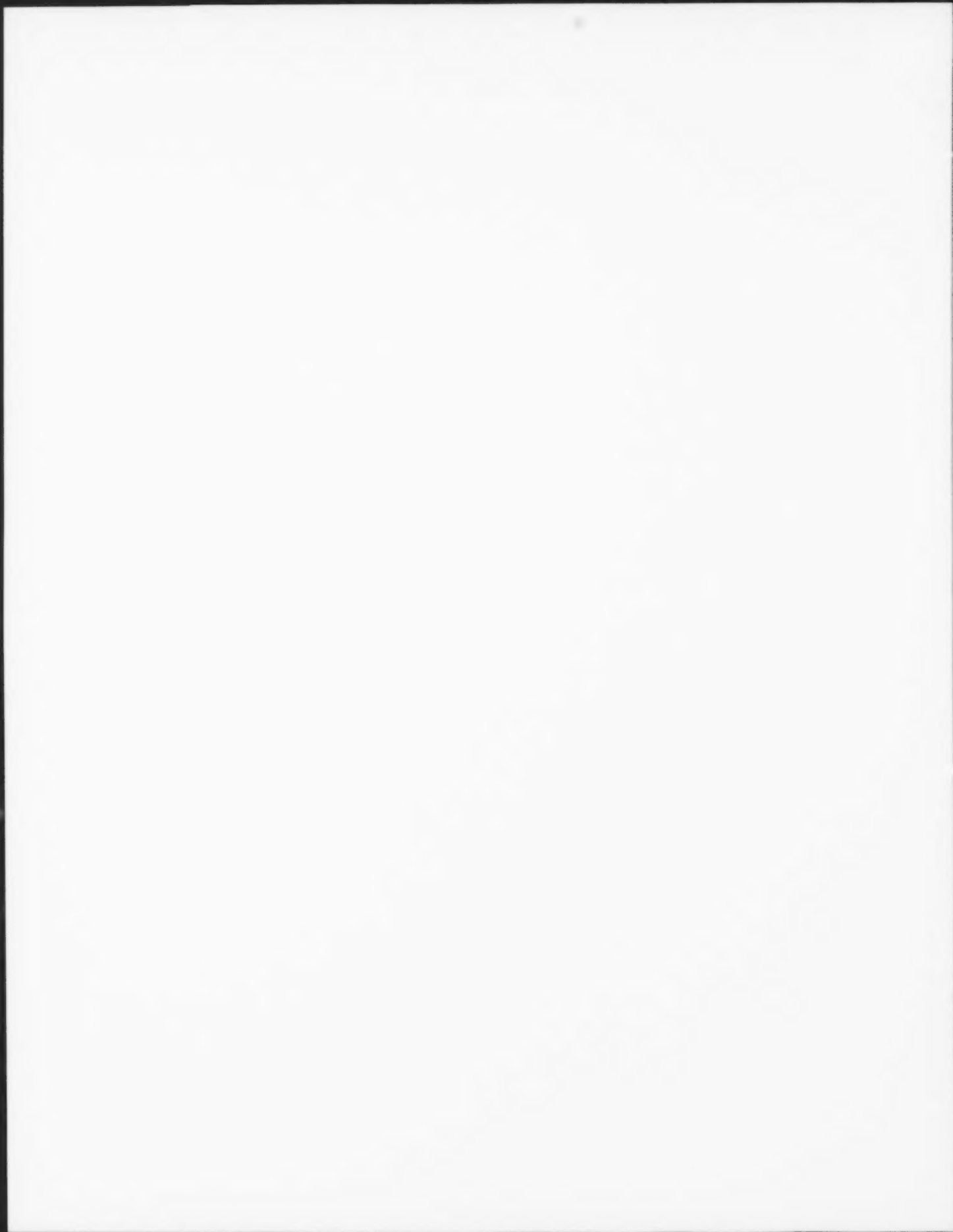


Table 3: Regeneration Delay Summary by Site Preparation Technique

Site Prep. Technique	N	Avg. RD From FPC Guidebook	Avg Actual RD
NONE	2083	5.47	2.69
ALL	472	5.47	2.72
Burn	203	4.77	2.19
Chem. Air	4	4.75	2.82
Chem. Grnd.	30	6.70	3.49
Manual	13	5.38	2.97
Mech.	222	5.96	3.08

Table 4: Regeneration Delay Summary by Intensity of Silviculture Treatment

Intensity (# treatments)	N	Avg. RD From FPC Guidebook	Avg Actual RD
0	157	6.54	3.68
All > 0	2351	5.39	2.62
1	843	5.77	2.61
2	1276	5.30	2.66
3	232	4.45	2.41

